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(पहला पुनरीक्षण)

Indian Standard

MAGNETIC OXIDE CORES (ETD-CORES) INTENDED FOR USE IN POWER SUPPLY APPLICATIONS — DIMENSIONS

(First Revision)

ICS 29.100.10

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BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

December 2001 **Price Group 9**

Magnetic Components and Ferrite Materials Sectional Committee, LTD 13

NATIONAL FOREWORD

This Indian Standard (First Revision) which is identical with IEC 1185 (1992) 'Magnetic oxide cores (ETD-cores) intended for use in power supply applications — Dimensions' including Amendment 1 (1995) issued by the International Electrotechnical Commission (IEC) was adopted by the Bureau of Indian Standards on the recommendation of Magnetic Components and Ferrite Materials Sectional Committee and approval of the Electronics and Telecommunication Division Council.

This standard specifies the dimensions that are of importance for mechanical interchangeability for ETD-cores made of magnetic oxides.

This standard has been revised to include the dimensions of five new types of ETD-cores, namely ETD 19, ETD 24, ETD 29, ETD 54 and ETD 59. Besides, the values of some parameters of the existing four types of ETD-cores, namely ETD 34, ETD 39, ETD 44 and ETD 49 have also been modified.

The text of the IEC has been approved as suitable for publication as Indian Standard without deviations. Certain conventions are, however, not identical to those used in Indian Standards. Attention is particularly drawn to the following:

a) Wherever the words 'International Standard' appear referring to this standard, they should be read as 'Indian Standard'.

b) Comma (,) has been used as a decimal marker while in Indian Standards, the current practice is to use a point (.) as the decimal marker.

CROSS REFERENCES

The concerned Technical Committee responsible for preparation of this standard has reviewed the provisions of the following International Publications and has decided that they are acceptable for use in conjunction with this standard:

IEC 205 (1966)	Calculation of the effective parameters of magnetic piece parts (since revised in 2001)
IEC 367-1 (1982)	Cores for inductors and transformers for telecommunications — Part 1: Measuring methods
ISO 370 (1975)	Toleranced dimensions — Conversion from inches to millimetres and *vice versa*

Only the English language text of the International Standard has been retained while adopting it in this Indian Standard.

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IS 13342 : 2001
IEC 1185 (1992)

Indian Standard

MAGNETIC OXIDE CORES (ETD-CORES) INTENDED FOR USE IN POWER SUPPLY APPLICATIONS — DIMENSIONS

(First Revision)

1 Scope and object

This International Standard specifies the dimensions that are of importance for mechanical interchangeability for ETD-cores made of magnetic oxides, the essential dimensions of coil formers to be used with them, and the effective parameter values to be used in calculations involving them.

NOTES

1 Whilst this standard mainly applies to magnetic oxide cores, its validity for iron powder cores should not be overlooked.

2 The cores covered by this standard are designed for use in power transformers and chokes operating at high flux density and generally at frequencies higher than those feasible with EC cores of the same material, due to a core proportioning more suitable for high frequency applications. They are generally used in pairs.

The use of "derived" standards which give more detailed specifications of component parts whilst still permitting compliance with this standard is discussed in annex A, which also contains an example of a derived standard for coil formers.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All normative documents are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the normative documents listed below. Members of IEC and ISO maintain registers of currently valid International Standards.

IEC 205: 1966, *Calculation of the effective parameters of magnetic piece parts*

IEC 367-1: 1982, *Cores for inductors and transformers for telecomunications – Part 1: Measuring methods*

ISO 370: 1975, *Toleranced dimensions – Conversion from inches to millimetres and vice versa*

3 Conversion system

3.1 The original system is the metric system.

3.2 Toleranced dimensions have been converted by applying the rules of method A of ISO 370*.

No rule is laid down for the conversion of the nominal value, but in cases where the converted dimensions are given as a nominal dimension with symmetrical tolerance, it is normal practice to state that nominal value with the same number of decimal places as the limits.

3.3 Single-limit millimetre dimensions (minimum or maximum) have been converted by applying the appropriate conversion table of ISO 370 and rounding to two more decimal places than the original value in a given column relating to a particular dimension.

4 Primary standards

Compliance with the following requirements ensures mechanical interchangeability of complete assemblies and coil formers.

4.1 *Dimensions of ETD-cores*

4.1.1 *Principal dimensions*

The principal dimensions of ETD-cores shall be given in table 1.

NOTE - The dimensions of the cores may be checked by means of gauges. By way of example, a possible standard for these gauges is given in annex B. In order to facilitate production it may be necessary to use gauges having dimensions differing from those given in annex B, although no relaxation of the requirements for the dimensions of the cores given in table 1 is permitted.

4.1.2 *Effective parameter and A_{min} values*

The effective parameter values of a pair of cores whose dimensions comply with 4.1.1 shall be as given in table 2 (see IEC 205 for definitions of these parameters and their calculation; and item 3 of subclause 17.6 of IEC 367-1, for the definition of A_{min}).

4.2 *Dimensional limits for coil formers*

The essential dimensions of coil formers suitable for use with a pair of ETD-cores shall be as given in table 3.

---

* For practical cases, the converted dimensions will normally be given with not more than three decimal places. The conversion rules may, however, result in more than three decimal places in order to keep the tolerance loss at a minimum.

In general, it is left to the users of this standard to apply further rounding, but such further rounding has been introduced where it would not cause the two original millimetre limits to be exceeded by more than 2,5 % of the tolerance (i.e. the difference between the two limits).

4.3 *Pin locations and base outlines*

These shall be as shown in figure 1, in which the base is viewed in the mounting direction, i.e. from the upper side of the printed wiring board.

NOTE - The module, designated as *m*, shown in the grid plan may be either 2,50 mm or 2,54 mm.

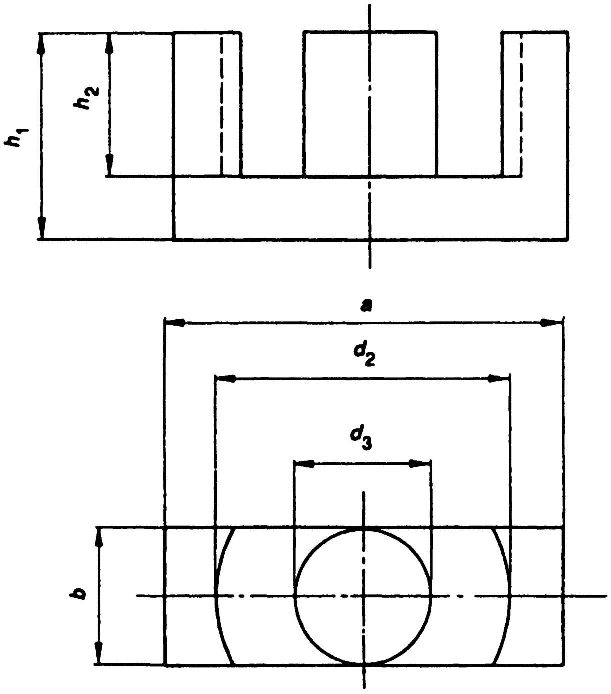
4.4 *Pin diameter*

Coil former terminations (pins) shall be accepted by a gauge having 1,2 mm holes on true position.

5 Marking

Where a coil former is fitted with termination pins conforming to a 2,50 mm module, it shall be clearly and indelibly marked with the letter M, in such a position that it can readily be seen in the completed component.

Table 1 – Dimensions of ETD-cores



Size		ETD 34	ETD 39	ETD 44	ETD 49	Units
a	min	33,4	38,2	43,0	47,6	mm
		1,315	1,504	1,693	1,874	in
	max	35,0	40,0	45,0	49,8	mm
		1,378	1,575	1,772	1,961	in
d_2	min	25,6	29,3	32,5	36,1	mm
		1,008	1,154	1,280	1,421	in
	max	27,0	30,9	34,1	37,9	mm
		1,063	1,217	1,343	1,492	in
d_3	min	10,5	12,2	14,4	15,9	mm
		0,413	0,480	0,567	0,626	in
	max	11,1	12,8	15,2	16,7	mm
		0,437	0,504	0,598	0,657	in
h_1	min	17,1	19,6	22,1	24,5	mm
		0,6732	0,7717	0,8701	0,9646	in
	max	17,5	20,0	22,5	24,9	mm
		0,6890	0,7874	0,8851	0,9803	in
h_2	min	11,8	14,2	16,1	17,7	mm
		0,465	0,559	0,634	0,697	in
	max	12,4	15,0	16,9	18,5	mm
		0,488	0,591	0,665	0,728	in
b	min	10,5	12,2	14,4	15,9	mm
		0,413	0,480	0,567	0,626	in
	max	11,1	12,8	15,2	16,7	mm
		0,437	0,504	0,598	0,657	in

Table 2 – Effective parameter and A_{min} values

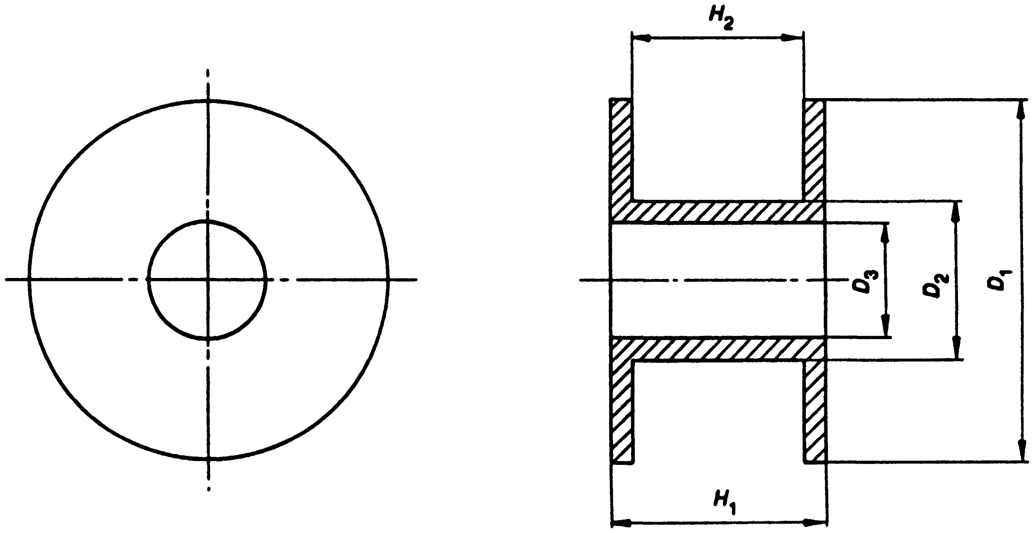
Effective parameter and A_{min}	Unit	Size			
		ETD 34	ETD 39	ETD 44	ETD 49
Core factor C_1 ($\Sigma \frac{l}{A}$)	mm^{-1}	0,814 1	0,741 6	0,598 8	0,542 1
Core factor C_2 ($\Sigma \frac{l}{A^2}$)	mm^{-3}	8,379 × 10^{-3}	5,933 × 10^{-3}	3,458 × 10^{-3}	2,566 × 10^{-3}
Effective magnetic length l_e	mm	79	93	104	115
Effective cross-sectional area A_e	mm^2	97	125	173	211
A_{min} (see 17.6.3 of IEC 367-1)	mm^2	92	123	172	209
Effective volume V_e	mm^3	7 700	11 600	18 000	24 200

NOTES

1 The manufacturers may indicate in their catalogues more precise values than those given in the above table

2 The above values have been calculated using the method given in 3.5 of IEC 205, with the exception of the formula for l_2 and A_1, where the approximate fomulae given in annex C, with their derivation, have been used

Table 3 – Essential dimensions of coil formers



Size	ETD 34	ETD 39	ETD 44	ETD 49	Units
D_1 min.	25,2 0,992	28,8 1,134	32,0 1,260	35,5 1,398	mm in
D_2 max.	13,6 0,535	15,3 0,602	17,7 0,697	19,5 0,768	mm in
D_3 min.	11,3 0,445	13,0 0,512	15,4 0,606	17,0 0,669	mm in
H_1 max.	23,4 0,921	28,2 1,110	32,0 1,260	35,2 1,386	mm in
H_2 min.	20,9 0,823	25,7 1,012	29,5 1,161	32,7 1,287	mm in

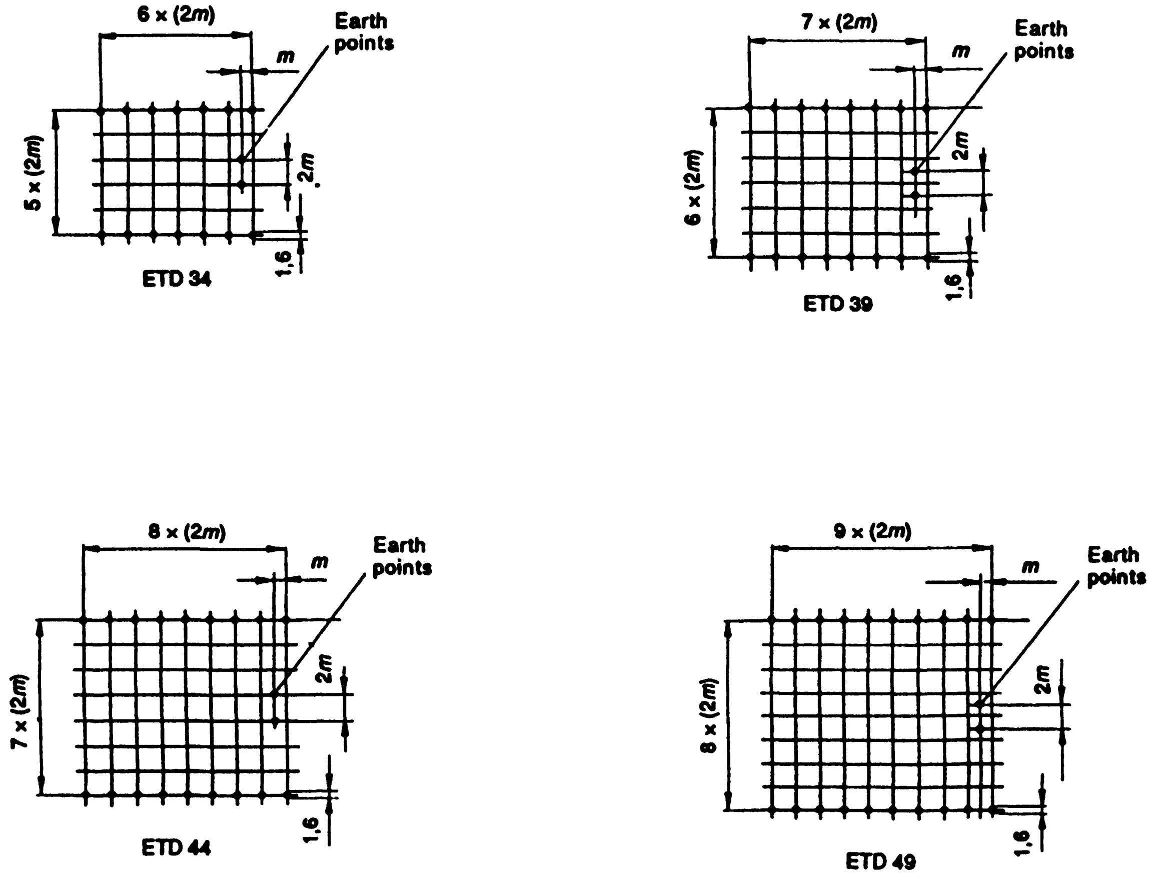


Figure 1 – Pin locations and base outlines viewed from the upper-side of the board (see 4.3)

Annex A
(normative)

Derived standards

Clauses 1 to 5 of this primary standard establish the values for the principal dimensions of core assemblies and wound coil-formers and enable full interchangeability for components complying with this primary standard to be achieved.

Parties interested in making or using ETD-cores may find it desirable to lay down local standards for everyday use, which show the dimensions and tolerances in greater detail than clause 4, and which correspond to the state of the art in that area. These specifications are known as "derived standards". When doing so, care should be taken not to exclude any other type of ETD-core meeting this primary standard, that would also satisfy the performance specification valid for a specific case.

It should be noted that even if a component complies with a derived standard and with the requirements of clause 4 of this primary standard, therefore permitting core assemblies and coil formers to be freely interchanged, its constituent parts may not necessarily be interchangeable.

When requirements lead to the establishment of a national standard, the relevant national standardization body is strongly requested to insert a note in such a national standard stating that:

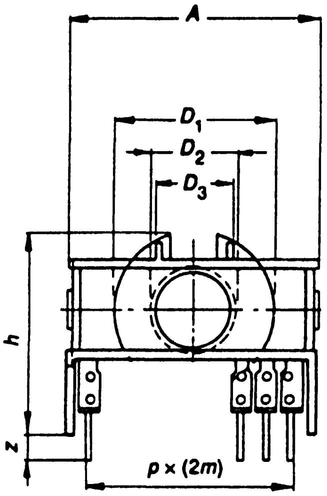
i) it is in accordance with the dimensional requirements of this present primary standard but that more details are given in order to promote its practical use;

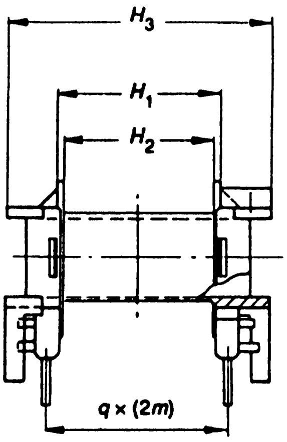
ii) other solutions are possible within the framework of this primary standard and should not be excluded if the resulting core and formers are functionally interchangeable with those of the national standard.

By way of example, a possible derived standard for coil formers is given below.

Example of a standard for the main dimensions of coil-formers for ETD-cores meeting this primary standard

Table A.1 - Main dimensions





z = 4,5 ± 0,5 mm = 0,177 ± 0,02 in

Size	ETD 34	ETD 39	ETD 44	ETD 49	Units
H_3 max.	42,8 1,685	47,8 1,882	52,5 2,067	57,5 2,264	mm in
H_1 max.	23,4 0,921	28,2 1,110	32,0 1,260	35,2 1,386	mm in
H_2 min.	20,9 0,823	25,7 1,012	29,5 1,161	32,7 1,287	mm in
A max.	39,6 1,559	44,6 1,756	49,6 1,953	54,5 2,146	mm in
D_1 min.	25,2 0,992	28,9 1,138	32,0 1,260	35,7 1,406	mm in
D_2 max.	13,4 0,526	15,1 0,594	17,5 0,689	19,0 0,748	mm in
D_3 min.	11,4 0,449	13,1 0,516	15,5 0,610	17,0 0,669	mm in
h max.	34,9 1,374	37,6 1,480	40,4 1,591	42,9 1,689	mm in
p	6	7	8	9	
q	5	6	7	8	

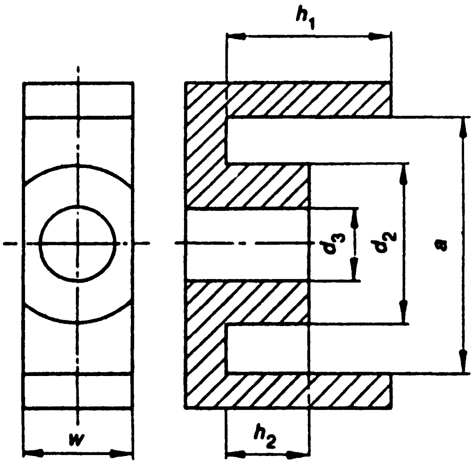
Annex B
(normative)

Example of a standard for gauges to check the dimensions of ETD-cores meeting this primary standard

B.1 General

The gauges shall be in accordance with table B.1.1 and its associated figure.

Table B.1.1 - Gauge dimensions



Size		ETD 34	ETD 39	ETD 44	ETD 49	Units
a	min.	35,005	40,005	45,005	49,805	mm
		1,3782	1,5752	1,7722	1,9612	in
	max.	35,015	40,015	45,015	49,815	mm
		1,3786	1,5756	1,7726	1,9616	in
d_2	min.	25,585	29,285	32,485	36,085	mm
		1,0074	1,1534	1,2794	1,4204	in
	max.	25,595	29,295	32,495	36,095	mm
		1,0078	1,1538	1,2798	1,4208	in
d_3	min.	11,105	12,805	15,205	16,705	mm
		0,4372	0,5042	0,5982	0,6572	in
	max.	11,115	12,815	15,215	16,715	mm
		0,4376	0,5046	0,5986	0,6576	in
h_1	min.	18	20	23	25	mm
		0,71	0,79	0,91	0,98	in
h_2	min.	11,80	14,20	16,10	17,70	mm
		0,4646	0,5591	0,6339	0,6969	in
	max.	11,81	14,21	16,11	17,71	mm
		0,4650	0,5595	0,6343	0,6972	in
w	min.	18	20	25	28	mm
		0,71	0,79	0,98	1,10	in

NOTE - The dimensions for a, d_2 and d_3 have not been converted by applying the conversion method of clause 3, but have been derived directly from the corresponding dimensions of the cores on the basis of the difference stated for the millimetre gauges, rounded to four decimal places in the inch system. Therefore, the use of these gauges is restricted to checking only cores manufactured in the same dimensional system, which means that gauges manufactured with millimetre dimensions can only be used for checking cores with millimetre dimensions, and gauges manufactured with inch dimensions for cores with inch dimensions.

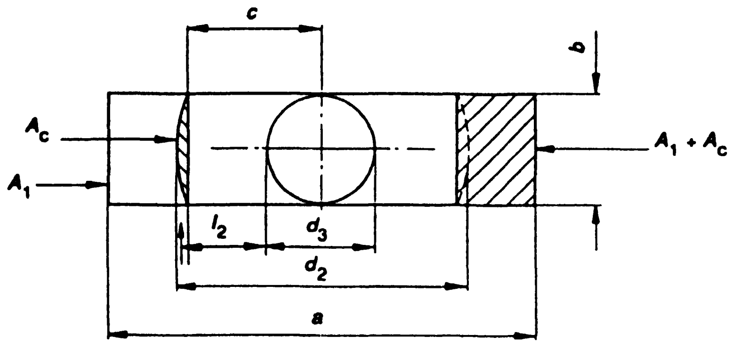
B.2 Procedure and requirements

To check the winding space, the gauge shall be fully inserted into the core without forcing; when fully inserted, the gauge shall meet the mating surface of the outer legs of core under test.

Annex C
(normative)

Derivation of formulae for l_2 and A_1

(see 3.5 of IEC 205)



l_2 is taken to be the mean value of $\frac{1}{2}(d_2 - d_3)$ and $(c - d_3 / 2)$

that is $$l_2 = \tfrac{1}{4}(d_2 - d_3 + 2c - d_3)$$
$$= \tfrac{1}{4}(d_2 - 2d_3 + 2c)$$

but $$c^2 = (\tfrac{1}{2} d_2)^2 - (\tfrac{1}{2} b)^2 = \tfrac{1}{4}(d_2^2 - b^2)$$

so that $$l_2 = \tfrac{1}{4}\left(d_2 + \sqrt{d_2^2 - b^2}\right) - \tfrac{1}{2} d_3$$

A_1 is equal to the rectangle $b(\frac{1}{2}a - c)$ *less* the cap or segment A_c (θ is given below)

$$A_c = \tfrac{1}{2}(\tfrac{1}{2} d_2)^2 \cdot (2\theta) - (\tfrac{1}{2} b) \cdot \left(\tfrac{1}{2}\sqrt{d_2^2 - b^2}\right)$$
$$= \tfrac{1}{4} d_2^2 \sin^{-1}(b / d_2) - \tfrac{1}{4} b \sqrt{d_2^2 - b^2}$$

hence $$A_1 = \tfrac{1}{2} ab - \tfrac{1}{2} b \sqrt{d_2^2 - b^2} - \tfrac{1}{4} d_2^2 \sin^{-1}(b / d_2) + \tfrac{1}{4} b \sqrt{d_2^2 - b^2}$$
$$= \tfrac{1}{2} ab - \tfrac{1}{4} b \sqrt{d_2^2 - b^2} - \tfrac{1}{4} d_2^2 \sin^{-1}(b / d_2)$$

However, for a segment whose height is small compared with its base chord, it may be shown that the expression

2/3 × base × height

gives the area with negligible error (see below).

In the present case, this simplified formula has been used to obtain the following approximate results:

$$A'_c = {}^2/_3 \times b \times ({}^1/_2\, d_2 - c)$$

$$= \frac{b\,d_2}{3} - \frac{b\sqrt{d_2^2 - b^2}}{3}$$

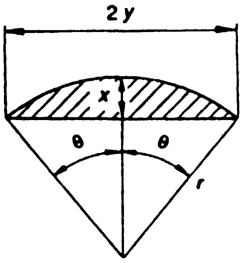
and hence

$$A'_1 = {}^1/_2\, ab - {}^1/_2\, b\sqrt{d_2^2 - b^2} - {}^1/_3\, bd_2 + {}^1/_3\, b\sqrt{d_2^2 - b^2}$$

$$= \frac{ab}{2} - \frac{b\,d_2}{3} - \frac{b\sqrt{d_2^2 - b^2}}{6}$$

where A'_c and A'_1 are the approximate values of A_c and A_1, respectively.

Approximate area of segment



Let A = area of segment

$A = r^2\theta - y(r - x)$

where $\theta = \sin^{-1}(y/r)$

and $r^2 = y^2 + (r - x)^2$

whence $r = \dfrac{y^2 + x^2}{2x}$

The function $f(p) = \sin^{-1}(p)$ has the expansion $p + p^3/6 + 3p^5/40$ ...

Taking the first two terms and substituting for θ in the expression for A gives :

$$A = r^2\,(y/r) + r^2\,(y/r)^3/6 - yr + yx$$

$$= xy + y^3/6r$$

$$= xy + \frac{y^3}{6} \cdot \frac{2x}{y^2 + x^2} = xy + \frac{xy}{3} \cdot \left(\frac{1}{1 + (x/y)^2}\right)$$

$$\approx \frac{4}{3}\,xy \approx \frac{2}{3}\ \text{(base)} \times \text{(height)}$$

AMENDMENT NO. 1

Page 1

CONTENTS

Add the title of clause 6 as follows:

6 Mounting

Page 5

Add the following new clause 6:

6 Mounting

According to their sizes and respective weights, it is recommended to fix the two largest cores (ETD 54 and ETD 59) on the printed board by means of two screws located at two opposite sides of their coil formers.

Concerning smaller sizes such as ETD 19 and ETD 24, no mounting assemblies are defined. It is recommended to fix the two cores by glue or adhesive tape.

Page 6

Table 1 – Dimensions of ETD-cores

Add the following new values:

Size		ETD 19	ETD 24	ETD 29	ETD 54	ETD 59	Units
a	min	19,1	23,8	29,0	53,2	58,4	mm
		0,752	0,937	1,142	2,094	2,299	in
	max.	20,1	25,0	30,6	55,8	61,2	mm
		0,791	0,984	1,205	2,197	2,409	in
d_2	min.	14,4	18,0	22,0	40,1	43,6	mm
		0,567	0,709	0,866	1,579	1,717	in
	max	15,4	19,2	23,4	42,3	45,8	mm
		0,606	0,756	0,921	1,665	1,803	in
d_3	min.	7,2	8,2	9,2	18,5	21,2	mm
		0,283	0,323	0,362	0,728	0,835	in
	max.	7,6	8,8	9,8	19,3	22,1	mm
		0,299	0,346	0,386	0,760	0,870	in
h_1	min.	13,5	14,3	15,6	27,4	30,8	mm
		0,531	0,563	0,614	1,079	1,213	in
	max.	13,8	14,6	16,0	27,8	31,2	mm
		0,543	0,575	0,630	1,094	1,228	in
h_2	min.	9,2	9,9	10,7	19,8	22,0	mm
		0,362	0,390	0,421	0,780	0,866	in
	max	9,6	10,3	11,3	20,6	22,9	mm
		0,378	0,406	0,445	0,811	0,902	in
b	min.	7,2	8,2	9,2	18,5	21,2	mm
		0,283	0,323	0,362	0,728	0,835	in
	max	7,6	8,8	9,8	19,3	22,1	mm
		0,299	0,346	0,386	0,760	0,870	in

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Table 2 – Effective parameter and A_{min} values

Add the following new values:

Effective parameter and A_{min}	Unit	Size				
		ETD 19	ETD 24	ETD 29	ETD 54	ETD 59
Core factor C_1	mm^{-1}	1,253 9	1,053 7	0,927 07	0,455 01	0,382 24
Core factor C_2	mm^{-3}	$28{,}412 \times 10^{-3}$	$17{,}811 \times 10^{-3}$	$12{,}139 \times 10^{-3}$	$1{,}6251 \times 10^{-3}$	$1{,}0389 \times 10^{-3}$
Effective magnetic length l_e	mm	55,3	62,3	70,8	127	141
Effective cross-sectional area A_e	mm^2	44,1	59,2	76,4	280	368
A_{min} (see 17 6 3 of IEC 367-1)	mm^2	39,5	55,0	70,9	280	366
Effective volume V_e	mm^3	2 440	3 690	5 410	35 700	51 700

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Table 3 – Essential dimensions of coil formers

Add the following new values:

Size	ETD 19	ETD 24	ETD 29	ETD 54	ETD 59	Units
D_1 max	14,1 0,555	17,6 0,693	21,6 0,850	39,5 1,555	43,0 1,693	mm in
D_2 max	9,8 0,386	11,0 0,433	12,0 0,472	22,1 0,870	24,9 0,980	mm in
D_3 min	7,8 0,307	9,0 0,354	10,0 0,394	19,6 0,772	22,4 0,882	mm in
H_1 max	18,2 0,717	19,6 0,772	21,2 0,835	39,3 1,547	43,7 1,720	mm in
H_2 min	15,9 0,626	17,1 0,673	19,2 0,756	36,8 1,449	41,2 1,622	mm in

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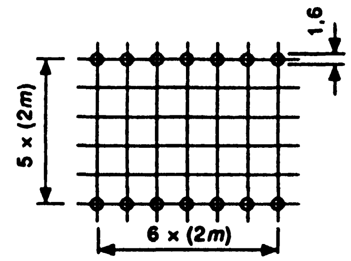
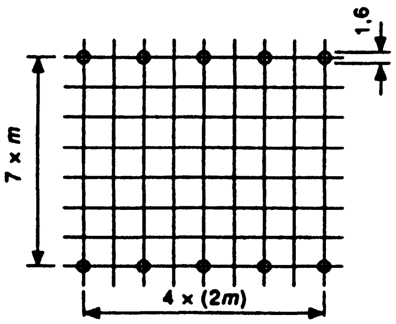
Figure 1 – Pin locations and base outlines viewed from the upper-side of the board (see 4.3)

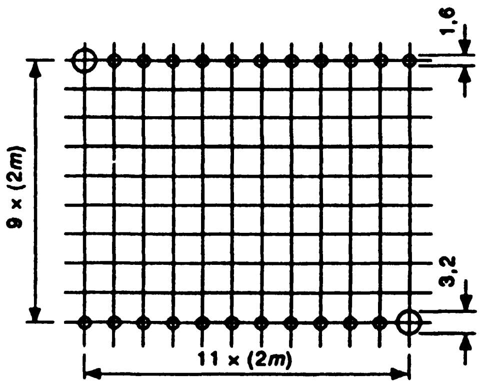
Add the following new figures:



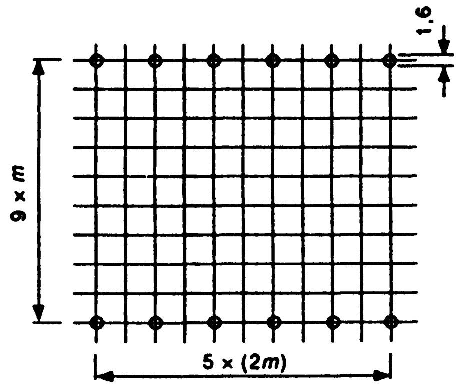
ETD 29



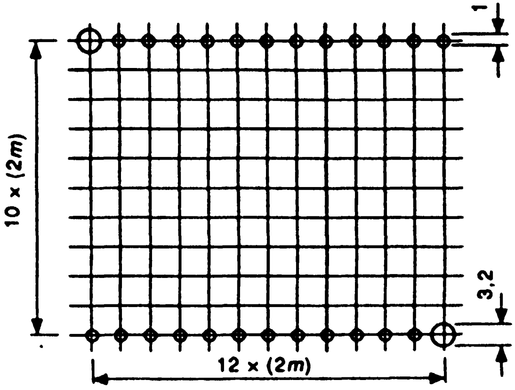
ETD 19



ETD 54



ETD 24



ETD 59

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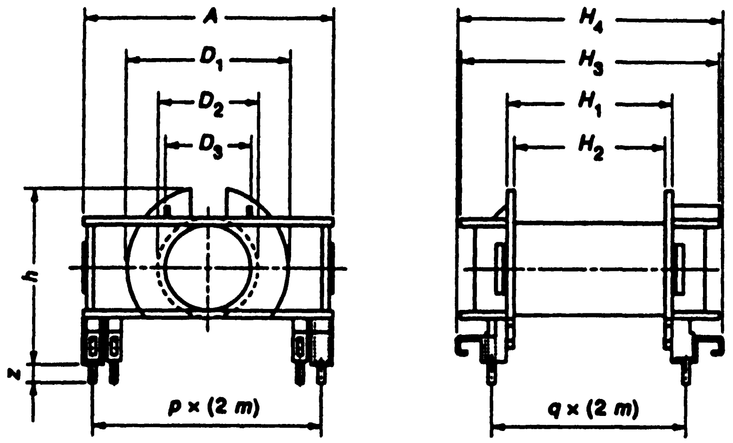
Table A.1 – Main dimensions

Replace D_1 min. *by* D_1 max. *Add the following new values and note:*



ETD 54 and EDT 59

Size	ETD 29	ETD 54	ETD 59	Units
H_3 max.	35,2 1,386	61,4 2,417	66,4 2,614	mm in
H_1 max.	21,2 0,835	39,3 1,547	43,7 1,720	mm in
H_2 min.	19,2 0,756	36,2 1,425	40,7 1,602	mm in
A max.	35,3 1,390	61,5 2,421	66,9 2,634	mm in
D_1 max.	21,6 0,850	39,4 1,551	42,9 1,689	mm in
D_2 max.	11,8 0,465	21,6 0,850	24,6 0,969	mm in
D_3 min.	10,0 0,394	19,6 0,772	22,4 0,882	mm in
h max.	25,0 0,984	43,0 1,693	46,0 1,811	mm in
p	6	11	12	
q	5	9	10	
H_4 max.	- -	64,0 2,520	69,0 2,717	mm in
NOTE – Not applicable to ETD 19 and ETD 24.				

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Table B.1.1 – Gauge dimensions

Add the following new values:

Size	ETD 19	ETD 24	ETD 29	ETD 54	ETD 59	Units
a min.	20,105	25,005	30,605	55,805	61,205	mm
	0,791 53	0,984 45	1,204 92	2,197 05	2,409 65	in
max.	20,115	25,015	30,615	55,815	61,215	mm
	0,791 93	0,984 84	1,205 31	2,197 44	2,410 04	in
d_2 min.	14,385	17,985	21,985	40,085	43,585	mm
	0,566 34	0,708 07	0,865 55	1,578 15	1,715 94	in
max.	14,395	17,995	21,995	40,095	43,595	mm
	0,566 73	0,708 46	0,865 94	1,578 54	1,716 34	in
d_3 min.	7,605	8,805	9,805	19,305	22,105	mm
	0,299 41	0,346 65	0,386 02	0,760 04	0,870 28	in
max.	7,615	8,815	9,815	19,315	22,115	mm
	0,299 80	0,347 05	0,386 42	0,760 43	0,870 67	in
h_1 min.	14,0	15,0	16,0	28,0	32,0	mm
	0,551	0,591	0,630	1,102	1,260	in
h_2 min.	9,20	9,90	10,70	19,80	22,00	mm
	0,362 2	0,389 8	0,421 3	0,779 5	0,866 1	in
max.	9,21	9,91	10,71	19,81	22,01	mm
	0,362 6	0,390 2	0,421 7	0,780 0	0,866 5	in
w min.	14,0	15,0	16,0	28,0	32,0	mm
	0,551	0,591	0,630	1,102	1,260	in

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